DIRECT TESTIMONY AND EXHIBITS OF

BRANDON S. BICKLEY

ON BEHALF OF

THE SOUTH CAROLINA OFFICE OF REGULATORY STAFF

DOCKET NO. 2021-1-E

IN RE: ANNUAL REVIEW OF BASE RATES FOR FUEL COSTS FOR DUKE ENERGY PROGRESS, LLC

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS AND OCCUPATION.

A. My name is Brandon S. Bickley. My business address is 1401 Main Street, Suite 900, Columbia, South Carolina 29201. I am employed by the South Carolina Office of Regulatory Staff ("ORS") in the Energy Operations Division as a Regulatory Analyst.

Q. PLEASE STATE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

A. I received my Bachelor of Science Degree with a major in Mechanical Engineering from the University of South Carolina in 2010. From 2010 to 2013, I was employed as a Nuclear Engineer, Reactor Fuel Safety Officer, and Shift Refueling Engineer at Norfolk Naval Shipyard. In that capacity, I performed engineering and operational duties in support of the United States Navy related to reactor servicing, reactor fuel, special nuclear material, special nuclear projects, security, and safety. From 2013 to 2017, I was employed as an Inspections, Tests, Analyses, and Acceptance Criteria ("ITAAC") Engineer with South Carolina Electric & Gas Company ("SCE&G"). In that capacity, I performed ITAAC reviews and construction oversight for SCE&G. From 2017 to 2019, I was employed by Savannah River Remediation as a Senior Engineer. In that capacity, I performed systems

engineering duties in support of the Defense Waste Processing Facility for Savannah River Remediation. I began my employment with ORS as a Regulatory Analyst in July 2019.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA ("COMMISSION")?

A. Yes. I have previously testified before the Commission on several occasions including annual fuel proceedings, general rate cases, and a proceeding related to the Utility Facility Siting and Environmental Protection Act.

Q. WHAT IS THE MISSION OF THE OFFICE OF REGULATORY STAFF?

A. ORS represents the public interest as defined by the South Carolina General Assembly as follows:

> [T]he concerns of the using and consuming public with respect to public utility services, regardless of the class of customer, and preservation of continued investment in and maintenance of utility facilities so as to provide reliable and high-quality utility services.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY AND HOW DOES YOUR DIRECT TESTIMONY REPRESENT THE PUBLIC INTEREST?

A. The purpose of my direct testimony is to set forth ORS's recommendations resulting from ORS's examination and review of Duke Energy Progress, LLC's ("DEP" or "Company") power plant operations in the generation of electricity to meet the Company's retail customer requirements during the review period. The review period includes the actual data for March 2020 through February 2021 ("Actual Period"), estimated data for March 2021 through June 2021 ("Estimated Period"), and forecasted data for July 2021 through June 2022 ("Forecasted Period"). My review focused on ensuring the Company efficiently operated its plants and made every reasonable effort to minimize fuel costs so as to provide reliable and high-quality service to its customers.

Q. WAS THE REVIEW PERFORMED BY YOU OR UNDER YOUR SUPERVISION?

A. Yes, the review to which I testify was performed by me or under my supervision.

Q. PLEASE DESCRIBE YOUR REVIEW OF THE COMPANY'S PLANT OPERATIONS.

A. In preparation for this proceeding, ORS examined various fuel and performance documents related to the Company's electric generation and power plant outage and maintenance activities. ORS analyzed the Company's monthly fuel reports including power plant performance data, heat rate data, unit outages, and generation statistics. ORS also monitored electric generation statistics through industry and governmental publications.

ORS attended (via virtual participation) the April 21, 2021, Nuclear Regulatory Commission ("NRC") 2020 Annual Assessment Meeting for the Shearon Harris Nuclear Plant ("Harris") and the Brunswick Nuclear Plant ("Brunswick") as well as the May 5, 2021, NRC 2020 Annual Assessment Meeting for the Robinson Nuclear Plant ("Robinson"). Additionally, ORS met virtually with Company personnel from various departments to discuss and review the Company's electric generation, power plant outages and maintenance activities.

Q. DID ORS EXAMINE THE COMPANY'S PLANT OPERATIONS FOR THE ACTUAL PERIOD?

A. Yes. ORS reviewed the performance of the Company's generation units to determine if the Company made reasonable efforts to maximize unit availability and minimize fuel costs. ORS also reviewed the operating statistics of the Company's power plants by unit. Exhibit BSB-1 shows, in percentages, the average availability, average net

capacity, and average forced outage factors of the Company's major generation units during the Actual Period. This exhibit also includes the North American Electric Reliability Corporation ("NERC") national five-year (2015-2019) averages for availability, capacity, and forced outage factors for each type of generation plant.

Q. PLEASE EXPLAIN HOW OUTAGES ARE REPRESENTED ON EXHIBITS BSB-2 THROUGH BSB-4.

A. Exhibits BSB-2 and BSB-3 summarize outages lasting seven (7) or more days for major coal and natural gas units, respectively, during the Actual Period. While not all plant outages are included in these exhibits, all outages were reviewed. ORS reviewed the outages, including information and data provided by the Company in testimony and discovery, and discussed the outages with Company management. ORS found the outages to be reasonable based on ORS's review of the outage data from the Actual Period, forecasted outage data from Docket No. 2020-1-E, historical outage data from previous annual fuel proceedings, and industry experience.

Exhibit BSB-4 shows the duration, type, and cause of each outage for the nuclear units. During the Actual Period, there were two (2) scheduled refueling outages both requiring outage extensions, one (1) maintenance outage, and six (6) forced outages. ORS reviewed the outages, including information and data provided by the Company in testimony and discovery as well as associated NRC documents, and discussed the outages with Company management. ORS found the outages to be reasonable based on ORS's review of the outage data from the Actual Period, forecasted outage data from Docket No. 2020-1-E, historical outage data from previous annual fuel proceedings, and industry experience.

Q. WHAT WERE THE RESULTS OF ORS'S ANALYSIS OF THE COMPANY'S POWER PLANT OPERATIONS FOR THE ACTUAL PERIOD?

A. Based on ORS's review of the Company's operation of its generation facilities during the Actual Period, ORS determined that the Company made reasonable efforts to maximize unit availability and minimize fuel costs.

Q. DID ORS REVIEW THE COMPANY'S GENERATION MIX DURING THE ACTUAL PERIOD?

A. Yes. Exhibit BSB-5 shows the generation mix for the Actual Period by percentage and generation type. As shown in this exhibit, the Company's nuclear, coal, and natural gas plants contributed an average of 43.84%, 9.91% and 30.96%, respectively, of the Company's generation throughout the Actual Period. This equates to approximately 84.71% of the Company's generation for the Actual Period. The remainder of the generation was met through a mix of renewables (hydroelectric, solar, and biomass/biogas), purchased power, and Joint Dispatch Agreement ("JDA") purchases.

Q. DID ORS EXAMINE THE COMPANY'S FUEL COSTS ON A PLANT-BY-PLANT BASIS FOR THE ACTUAL PERIOD?

A. Yes. Exhibit BSB-6 shows the average fuel costs for the major generation plants on the Company's system for the Actual Period and the megawatt-hours ("MWh") produced by those plants. The exhibit shows the lowest average fuel cost of 0.578 cents/kilowatt-hour ("kWh") at both Robinson and Harris and the highest average fuel cost of 5.210 cents/kWh at the Mayo Plant. The Company utilizes economic dispatch which generally requires that the lower cost units be dispatched first.

Q. DID ORS REVIEW THE COMPANY'S FORECASTED POWER PLANT OPERATIONS FOR THE ESTIMATED AND FORECASTED PERIODS?

A. Yes. ORS reviewed the Company's maintenance schedules and projected performance data for its power plants for the Estimated and Forecasted Periods. ORS compared these schedules and performance data to previous maintenance schedules and performance data from Docket No. 2020-1-E, maintenance schedules and performance data from the Actual Period, and historical projections from previous annual fuel proceedings. Based on its review, ORS found the Company's maintenance schedules and projected data for its power plants for the Estimated and Forecasted Periods to be reasonable.

Q. DOES ORS RECOMMEND ANY ADJUSTMENTS TO THE FUEL FACTORS PROPOSED BY THE COMPANY?

A. No. ORS does not recommend any adjustments to the Fuel Factors based on the Company's power plant operations.

Q. WILL YOU UPDATE YOUR DIRECT TESTIMONY BASED ON INFORMATION THAT BECOMES AVAILABLE?

A. Yes. ORS fully reserves the right to revise its recommendations via supplemental testimony should new information not previously provided by the Company, or other sources, become available.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

EXHIBIT BSB-1

Office of Regulatory Staff

Power Plant Performance Data

Duke Energy Progress, LLC

Docket No. 2021-1-E

Coal Plants[1]	Unit	MW Rating	*Actual Period Data* Average Availability Factor (%)	Average Net Capacity Factor (%)	Average Forced Outage Factor (%)
Mayo	1	704	69.43	17.78	4.77
Roxboro	1	379	68.93	25.28	1.60
Roxboro	2	668	59.01	36.69	12.39
Roxboro	3	694	76.29	33.07	0.00
Roxboro	4	698	62.64	20.03	0.08
Coal Totals		**3,143**	**67.15**	**26.48**	**3.91**
NERC 5-year average (All Coal Plants)			***82.44***	***51.99***	***5.11***

CC Plants[2]	Unit	MW Rating	Average Availability Factor (%)	Average Net Capacity Factor (%)	Average Forced Outage Factor (%)
Lee	CC1	888	87.89	57.61	4.84
Richmond	CC4	475	89.91	60.09	1.06
Richmond	CC5	608	89.84	71.32	0.14
Sutton	CC1	607	90.45	63.43	0.04
Asheville[3]	CC1	238	81.33	63.46	1.60
Asheville[4]	CC2	238	85.01	65.70	2.04
CC Totals		**3,054**	**88.35**	**62.86**	**1.91**
NERC 5-year average (CC Plants)			***88.05***	***54.76***	***2.24***

Nuclear Plants	Unit	MW Rating	Average Availability Factor (%)	Average Net Capacity Factor (%)	Average Forced Outage Factor (%)
Brunswick	1	938	84.85	84.36	5.82
Brunswick	2	932	99.50	98.39	0.50
Harris	1	964	97.01	97.66	2.99
Robinson	2	759	91.06	91.79	2.37
Nuclear Totals		**3,593**	**93.10**	**93.13**	**2.37**
NERC 5-year average (All Nuclear Plants)			***92.65***	***91.73***	***1.54***

[1] Asheville Coal Units 1 and 2 Retired January 29, 2020

[2] CC designates Combined-Cycle units

[3] Asheville CC Unit 1: Commercial Operation Date for Power Block 1 - December 27, 2019

[4] Asheville CC Unit 2: Commercial Operation Date for Power Block 2 - April 5, 2020

Office of Regulatory Staff

EXHIBIT BSB-2

Coal Unit Outages - 7 Days or Greater Duration

Duke Energy Progress, LLC

Docket No. 2021-1-E

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Mayo 1	9/17/2020	10/31/2020	1,048.00	Maintenance	Unit taken offline to wash trays and repair pump spray header.
Mayo 1	10/31/2020	12/13/2020	1,041.00	Planned	Unit taken offline for planned Fall outage.
Mayo 1	12/13/2020	12/28/2020	369.00	Forced	Unit forced offline due to control valve issues.
Roxboro 1	3/1/2020	5/28/2020	2,118.00	Planned	Unit taken offline for planned Spring outage.
Roxboro 1	9/17/2020	9/28/2020	265.00	Maintenance	Unit taken offline to replace Main Turbine Turning Gear Oil Pump Upper Bearing.
Roxboro 2[1]	2/29/2020	5/31/2020	2,207.00	Planned	Unit taken offline for planned Spring outage.
Roxboro 2	5/31/2020	6/25/2020	623.42	Extension	Extension of planned Spring outage.
Roxboro 2	8/22/2020	8/29/2020	186.63	Maintenance	Unit taken offline for Boiler Circulation Water Pump repairs.
Roxboro 2	11/12/2020	11/26/2020	318.00	Forced	Unit forced offline due to the DFA system plugged.
Roxboro 3	3/31/2020	4/7/2020	177.50	Maintenance	Unit taken offline for Turbine Stop Valve inspection.
Roxboro 3	9/19/2020	11/23/2020	1,561.00	Planned	Unit taken offline for planned Fall outage.
Roxboro 3[2]	2/21/2021	3/3/2021	235.30	Maintenance	Unit taken offline to clean 3A and 3B SCRs.
Roxboro 4	3/7/2020	5/29/2020	2,007.00	Planned	Unit taken offline for planned Spring outage.
Roxboro 4	6/12/2020	6/20/2020	188.25	Maintenance	Unit taken offline due to Turbine 10th Stage Extraction Steam MOV Leak.
Roxboro 4	8/15/2020	8/23/2020	200.25	Maintenance	Unit taken offline due to Absorber Expansion Joint Leak Repairs.
Roxboro 4	12/11/2020	12/20/2020	230.03	Maintenance	Unit taken offline for Air Heater Wash.
Roxboro 4	1/1/2021	1/8/2021	185.00	Maintenance	Unit taken offline due to Boiler Tube Leak.
Roxboro 4	2/15/2021	2/24/2021	226.00	Maintenance	Unit taken offline to repair Cold Reheat Stop Valve.

[1] ***This outage began prior to the Actual Period.***

[2] ***This outage was completed after the Actual Period.***

EXHIBIT BSB-3

Office of Regulatory Staff

Natural Gas Unit Outages - 7 Days or Greater Duration

Duke Energy Progress, LLC

Docket No. 2021-1-E

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Asheville CC1	3/23/2020	4/13/2020	521.70	Planned	Unit taken offline for planned Spring outage.
Asheville CC1	5/5/2020	6/21/2020	1,118.38	Planned	Unit taken offline for planned Spring outage.
Asheville CC1	9/16/2020	9/25/2020	222.55	Forced	Unit forced offline due to Turbine Lube Oil Pumps tripped to low pressure.
Asheville CC1	11/25/2020	12/18/2020	547.25	Maintenance	Unit forced offline due to lube oil flush required due to biological growth.
Asheville CC2	4/5/2020	4/16/2020	264.27	Planned	Unit taken offline for planned Spring outage.
Asheville CC2	4/30/2020	5/12/2020	276.75	Maintenance	Unit taken offline to replace liquid fuel cartridges on gas turbine.
Asheville CC2	9/25/2020	10/25/2020	712.45	Maintenance	Unit taken offline for general maintenance and repairs.
Lee CC	5/21/2020	5/29/2020	188.00	Forced	Unit forced offline due to Auxiliary Boiler Tube leaks.
Lee CC	6/2/2020	6/12/2020	232.13	Planned	Unit taken offline for planned Spring outage.
Lee CC	10/2/2020	10/17/2020	370.33	Planned	Unit taken offline for planned Fall outage.
Lee CC	12/1/2020	12/19/2020	451.78	Forced	Unit forced offline due to Gas Turbine vibration.
Lee CC	1/9/2021	3/1/2021	1,217.05	Forced	Unit forced offline due to Gas Turbine vibration.
Richmond CC4	4/18/2020	4/25/2020	188.00	Planned	Unit taken offline for planned Spring outage.
Richmond CC4	10/14/2020	11/5/2020	539.90	Planned	Unit was taken offline for planned Fall outage.
Richmond CC4	10/30/2020	11/8/2020	211.67	Extension	Extension of planned Fall outage.
Richmond CC4	11/8/2020	11/18/2020	244.73	Forced	Unit was forced offline due to problems with newly repaired Hot ReHeat header.
Richmond CC5	2/28/2020	4/5/2020	886.53	Planned	Unit taken offline for planned Spring outage.
Sutton CC	4/11/2020	4/29/2020	432.00	Planned	Unit taken offline for planned Spring outage.
Sutton CC	9/5/2020	9/21/2020	401.37	Planned	Unit taken offline for planned Fall outage.

EXHIBIT BSB-4

Office of Regulatory Staff
Nuclear Unit Outages
Duke Energy Progress, LLC
Docket No. 2021-1-E

Unit	Date Offline	Date Online	Hours	Outage Type	Explanation of Outage
Brunswick 1	2/29/2020	3/25/2020	599.00	Planned	Unit taken offline for planned refueling outage.
Brunswick 1	3/25/2020	3/28/2020	72.02	Extension	Extension of refueling outage due to safety relief valve leak.
Harris 1	3/23/2020	3/25/2020	51.52	Forced	Unit forced offline due to unit trip from full power on hydraulic control header pressure loss.
Brunswick 1	6/13/2020	6/23/2020	241.52	Maintenance	Unit taken offline for mid-cycle fuel replacement outage to replace a defective fuel bundle.
Brunswick 1	8/3/2020	8/22/2020	438.20	Forced	Unit forced offline due to ground on main generator rotor.
Harris 1	8/13/2020	8/15/2020	59.30	Forced	Unit forced offline due to a manual unit trip during rod control testing due to a dropped control rod.
Brunswick 2	9/19/2020	9/20/2020	23.27	Forced	Unit forced offline due to the turbine offline to repair main generator phase "A" no-load disconnect switch.
Brunswick 2	10/9/2020	10/10/2020	20.13	Forced	Unit forced offline due to the turbine offline to repair main generator phase "C" no-load disconnect switch. Phase "B" was also repaired.
Robinson 2	11/7/2020	12/9/2020	768.00	Planned	Unit taken offline for planned refueling outage.
Robinson 2	12/9/2020	12/9/2020	15.48	Extension	Extension of refueling outage due to issues with containment sump level and rod control malfunctions.
Harris 1	12/16/2020	12/22/2020	150.90	Forced	Unit forced offline due to automatic SCRAM due to generator lockout from 1B5 non-segregated bus fault.

EXHIBIT BSB-5

Office of Regulatory Staff
Generation Mix (Percentage)
Duke Energy Progress, LLC
Docket No. 2021-1-E

	2020										2021		
	Mar	**Apr**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Average[1]**
Nuclear	41.78%	59.08%	52.83%	39.66%	35.89%	32.56%	45.72%	52.37%	45.51%	36.52%	42.34%	41.79%	**43.84%**
Coal	4.85%	-0.27%	0.30%	14.02%	18.54%	17.91%	10.58%	4.39%	2.28%	15.22%	14.12%	16.97%	**9.91%**
Natural Gas	35.11%	23.14%	27.77%	30.43%	31.54%	32.27%	29.64%	29.99%	33.51%	35.54%	33.07%	29.56%	**30.96%**
Hydroelectric	1.53%	1.61%	1.74%	1.10%	0.54%	0.96%	1.01%	1.47%	1.76%	1.52%	1.37%	1.65%	**1.36%**
Solar	0.40%	0.56%	0.48%	0.41%	0.36%	0.34%	0.34%	0.42%	0.37%	0.24%	0.23%	0.24%	**0.37%**
Wind	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**0.00%**
Biomass/Biogas[2]	0.03%	0.06%	0.04%	0.05%	0.03%	0.03%	0.04%	0.05%	0.03%	0.02%	0.03%	0.02%	**0.04%**
Purchased Power	12.27%	14.90%	15.95%	12.31%	12.86%	12.67%	12.19%	10.68%	12.90%	9.62%	7.71%	8.48%	**11.88%**
JDA Purchases	4.03%	0.92%	0.90%	2.03%	0.24%	3.26%	0.48%	0.64%	3.64%	1.32%	1.13%	1.30%	**1.66%**

[1] ***Average total may not equal 100% due to rounding.***

[2] ***Biogas is burned at DEP's Combined Cycle Units. The values shown above for Combined Cycle Units exclude the Biogas component.***

EXHIBIT BSB-6

Office of Regulatory Staff
Generation Statistics for Plants
Duke Energy Progress, LLC
Docket No. 2021-1-E

Plant	Fuel Type	Average Fuel Cost (Cents/kWh) [1]	Generation (MWh)
Robinson	Nuclear	0.578	6,102,751
Harris	Nuclear	0.578	8,246,924
Brunswick	Nuclear	0.595	14,964,260
Richmond CC	Natural Gas	2.381	7,250,931
Lee CC	Natural Gas	2.784	5,344,813
Asheville CC	Natural Gas	2.921	3,169,974
Sutton CC	Natural Gas	3.149	3,995,362
Roxboro	Coal	4.178	6,274,444
Mayo	Coal	5.210	1,153,828

[1] ***Includes Base Fuel and Environmental Costs.***